Qsynergy TAIWAN 2021
5G x AI
應用趨勢論壇

最佳跨架構AI應用程式平台

Joel Lin, Intel
Dec. 28th, 2021

QCT intel 採用Intel®科技

Choose the Best Accelerated Technology

Intel® oneAPI Tools for AI

Joel Lin
Dec. 28th, 2021

All information provided in this deck is subject to change without notice.
Contact your Intel representative to obtain the latest Intel product specifications and roadmaps.

Intel’s oneAPI Ecosystem

Built on Intel’s Rich Heritage of CPU Tools Expanded to XPUs

oneAPI

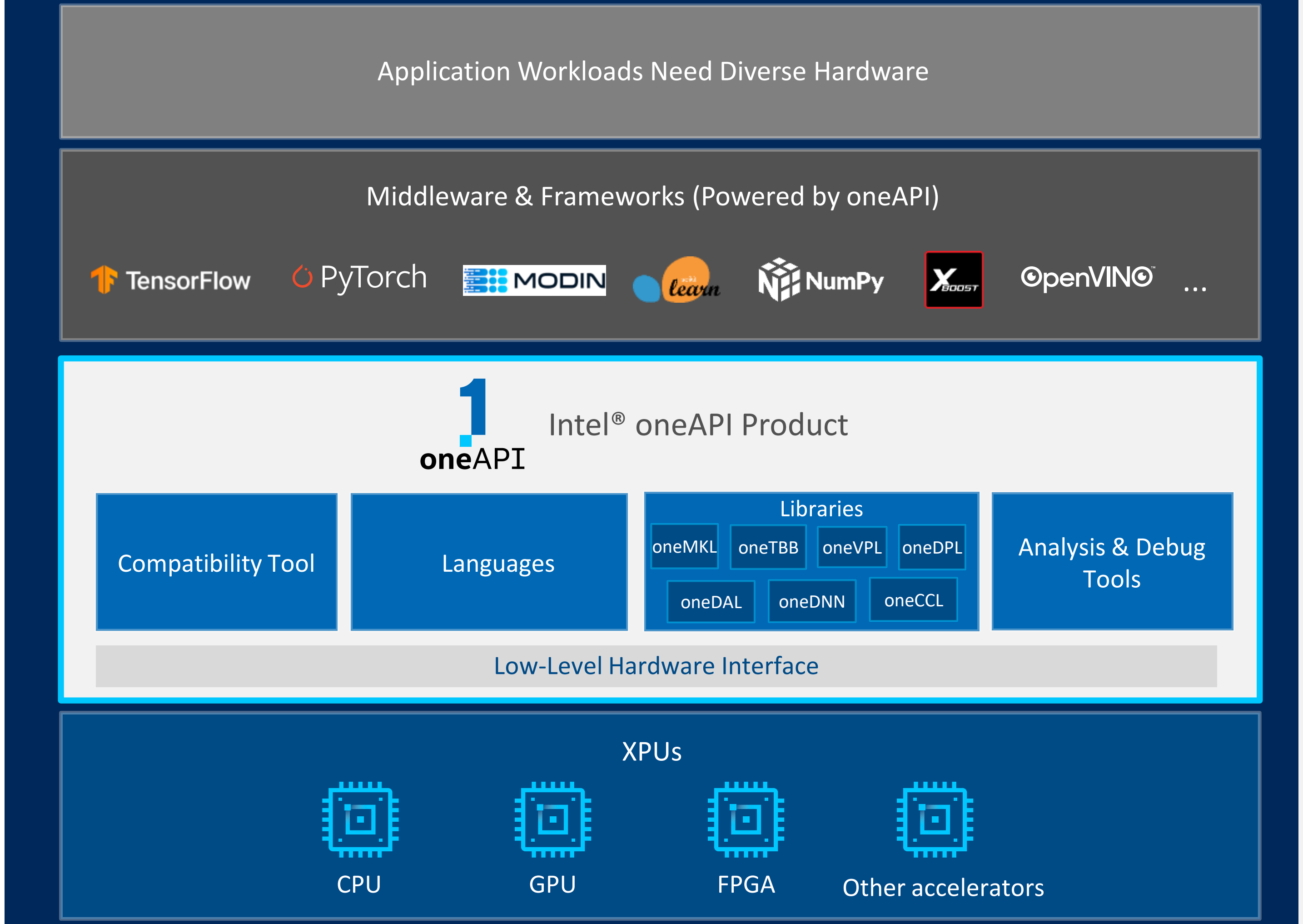
A cross-architecture language based on C++ and SYCL standards

Powerful libraries designed for acceleration of domain-specific functions

A complete set of advanced compilers, libraries, and porting, analysis and debugger tools

Powered by oneAPI

Frameworks and middleware that are built using one or more of the oneAPI industry specification elements, the DPC++ language, and libraries listed on oneapi.com.



Available Now

Visit software.intel.com/oneapi for more details
Some capabilities may differ per architecture and custom-tuning will still be required. Other accelerators to be supported in the future.

Intel oneAPI Software Tools for AI & Analytics

Intel® oneAPI Toolkits 2022 is released this December.
Find out more details on the online release notes.

Intel® oneAPI Toolkits

Intel® oneAPI AI Analytics Toolkit

Accelerate machine learning & data science pipelines with optimized deep learning frameworks & high-performing Python libraries

Data Scientists, AI Researchers, DL/ML Developers

Intel® oneAPI Base Toolkit

Incl. Intel® oneAPI Deep Neural Network Library (oneDNN), Intel® oneAPI Collective Communications Library (oneCCL), & Intel® oneAPI Data Analytics Library (oneDAL)

Optimize primitives for algorithms and framework development

DL Framework Developers - Optimize algorithms for Machine Learning & Analytics

Toolkit Powered by oneAPI

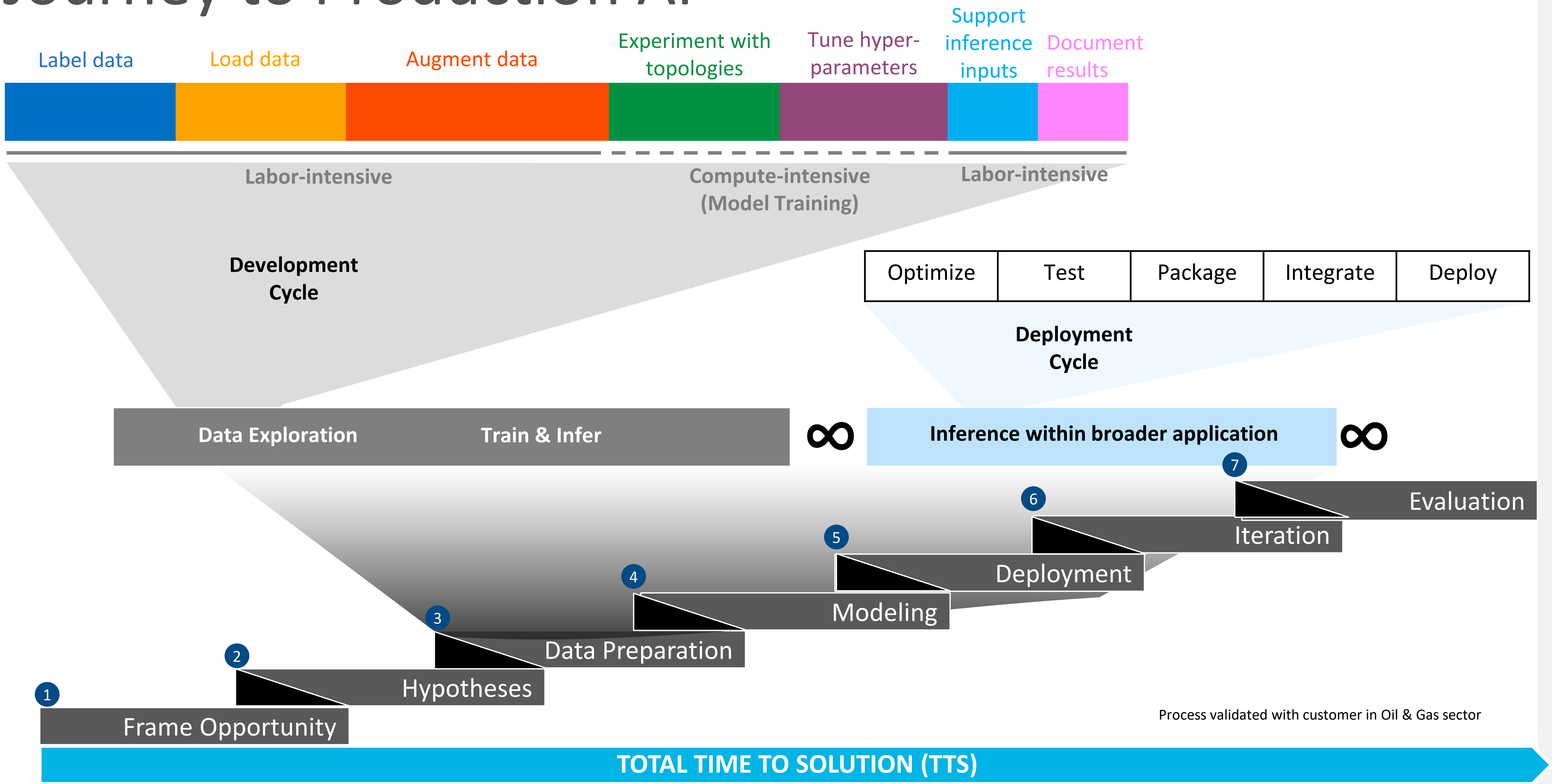
Intel® Distribution of OpenVINO™ Toolkit

Deploy high performance inference & applications from edge to cloud

AI Application, Media, & Vision Developers

OpenVINO™

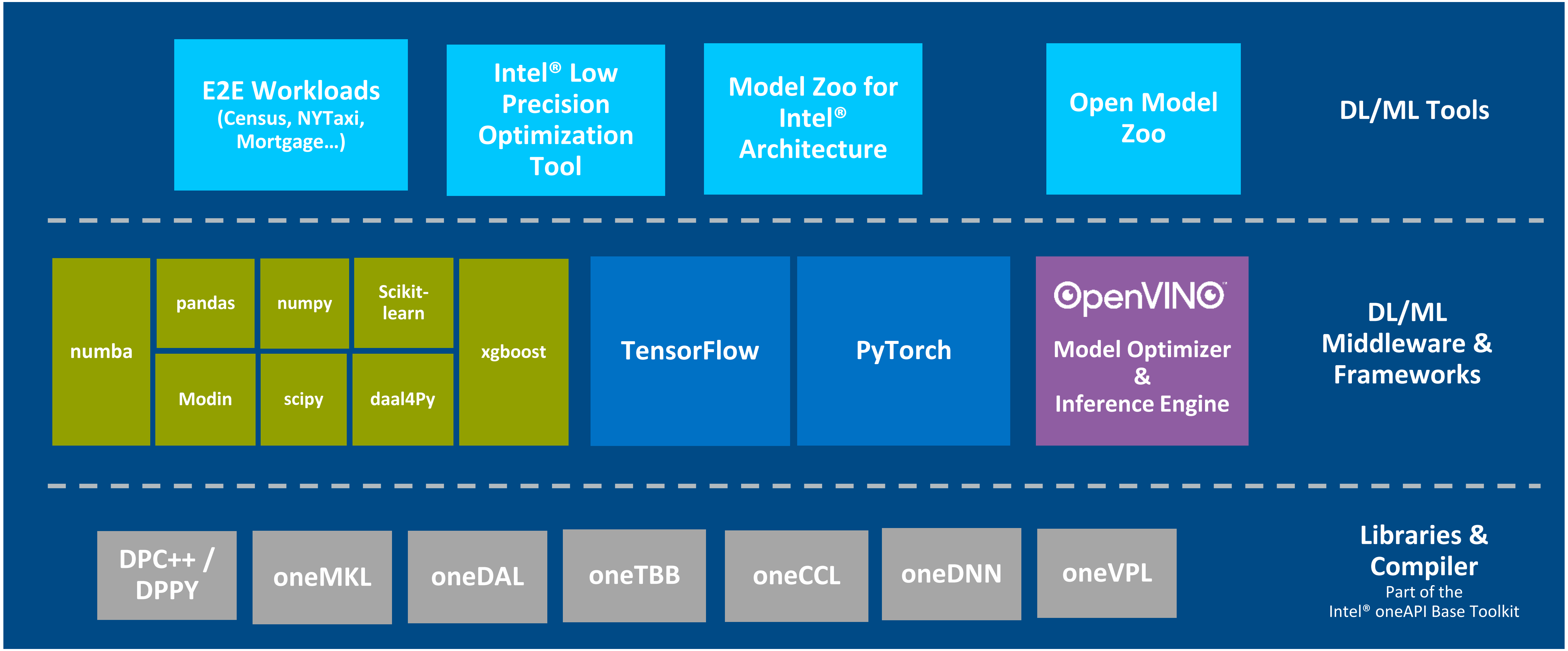
Journey to Production AI



Process validated with customer in Oil & Gas sector

AI Software Stack for Intel XPUs

Intel offers a Robust Software Stack to Maximize Performance of Diverse Workloads



E2E Workloads (Census, NYTaxi, Mortgage…)

Intel® Low Precision Optimization Tool

Model Zoo for Intel® Architecture

Open Model Zoo

DL/ML Tools

numba

pandas

numpy

Scikit-learn

Modin

scipy

daal4Py

xgboost

TensorFlow

PyTorch

OpenVINO™ Model Optimizer & Inference Engine

DL/ML Middleware & Frameworks

DPC++ / DPPY

oneMKL

oneDAL

oneTBB

oneCCL

oneDNN

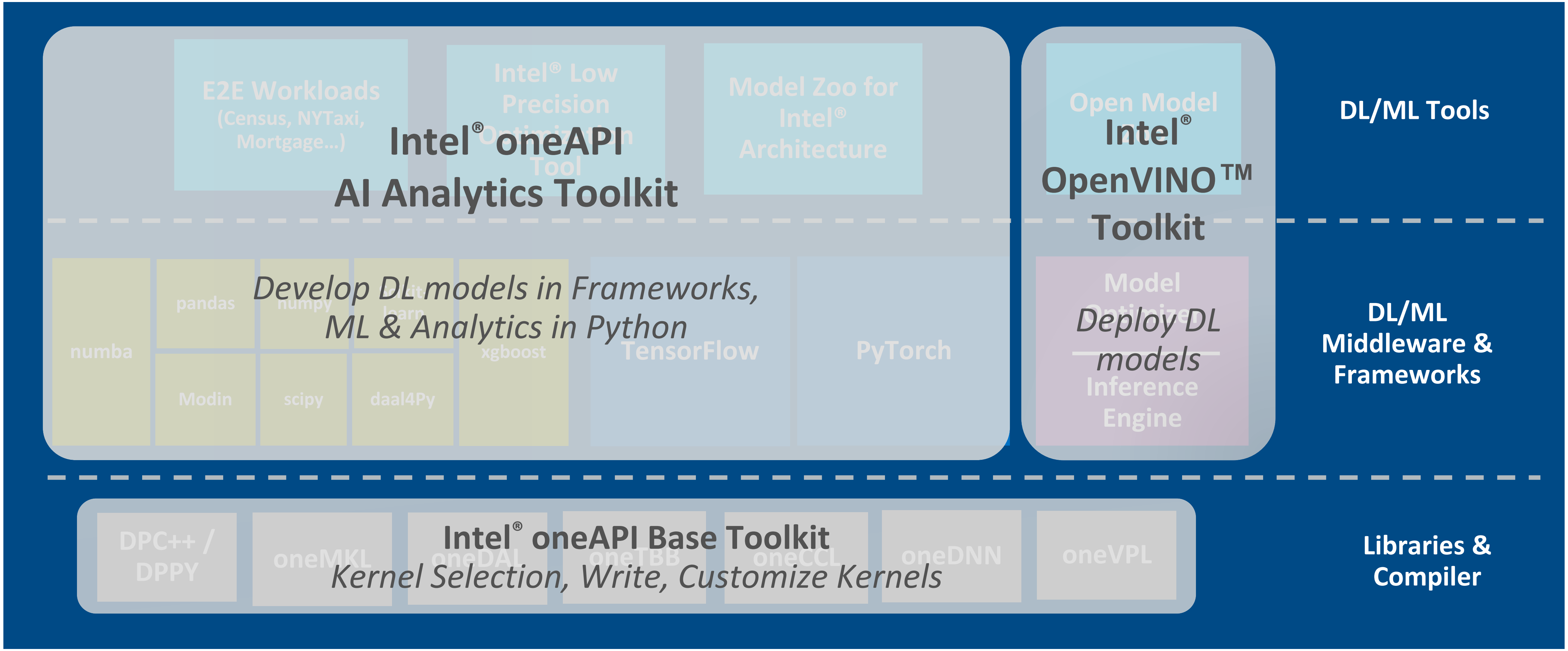
oneVPL

Libraries & Compiler

Part of the Intel® oneAPI Base Toolkit

AI Software Stack for Intel XPUs

Intel offers a Robust Software Stack to Maximize Performance of Diverse Workloads



Intel® oneAPI AI Analytics Toolkit

E2E Workloads (Census, NYTaxi, Mortgage...)

Intel® Low Precision Optimization Tool

Model Zoo for Intel® Architecture

Develop DL models in Frameworks, ML & Analytics in Python

numba

pandas

numpy

learn

xgboost

Modin

scipy

daal4Py

TensorFlow

PyTorch

Open Model

Intel® OpenVINO™ Toolkit

Model Optimizer

Deploy DL models

Inference Engine

DL/ML Tools

DL/ML Middleware & Frameworks

Intel® oneAPI Base Toolkit

Kernel Selection, Write, Customize Kernels

DPC++ / DPPY

oneMKL

oneDAL

oneTBB

oneCCL

oneDNN

oneVPL

Libraries & Compiler

Full Set of Intel oneAPI cross-architecture AI ML & DL Software Solutions

Intel® oneAPI Base Toolkit

Accelerate Data-centric Workloads

A set of core tools and libraries for developing high-performance applications on Intel® CPUs, GPUs, and FPGAs

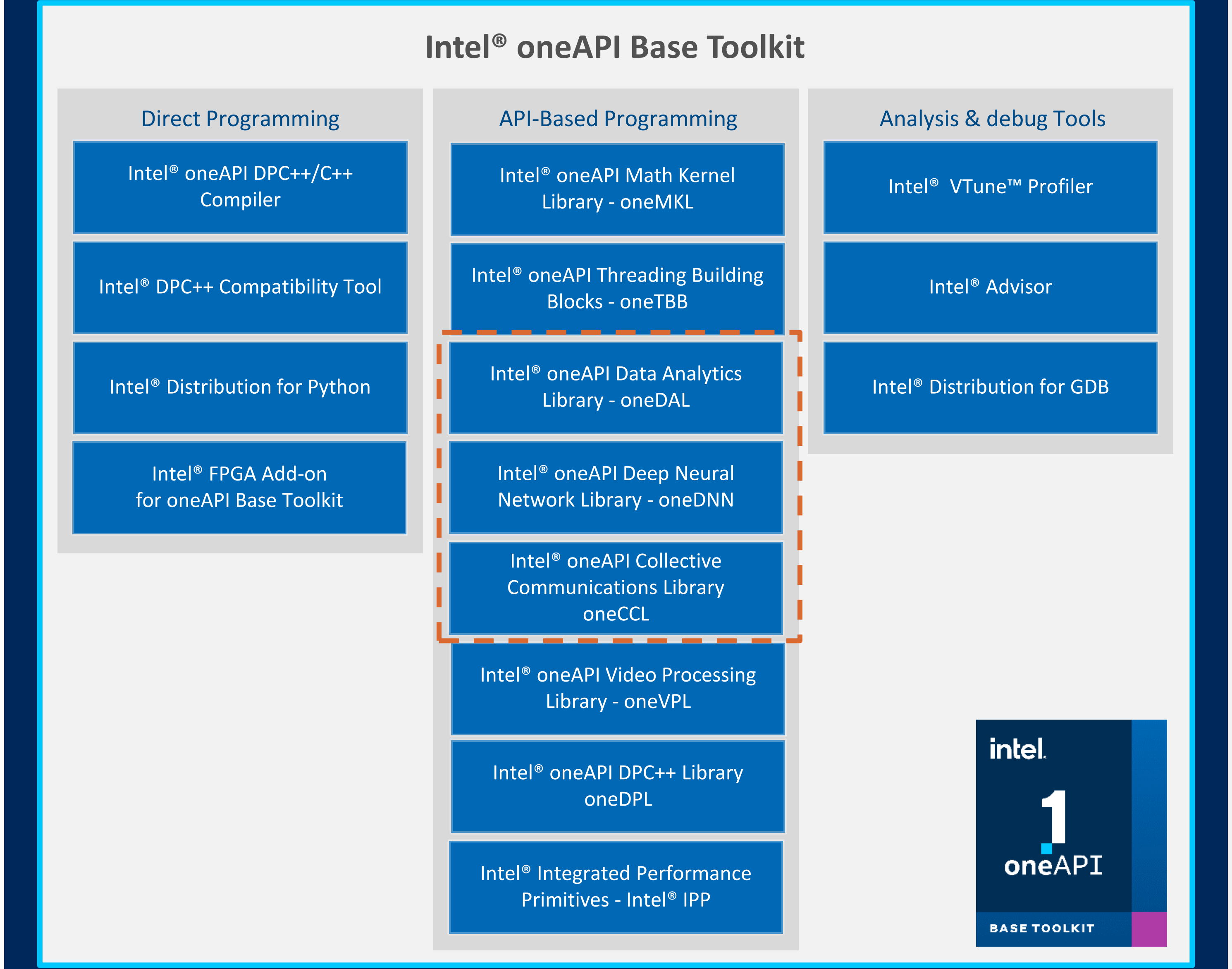
Intel® oneAPI IoT Toolkit 2022 is out. Find out more details on the release notes.

Who Uses It?

- A broad range of developers across industries
- Native Code Developers/Framework Developers

Top Features/Benefits

- Data Parallel C++ (DPC++) compiler, library and analysis tools; DPC++ Compatibility tool helps migrate existing code written in CUDA
- Optimized performance libraries for threading, math, data analytics, deep learning, and video/image/signal processing



Intel® oneAPI Base Toolkit

Direct Programming

- Intel® oneAPI DPC++/C++ Compiler
- Intel® DPC++ Compatibility Tool
- Intel® Distribution for Python
- Intel® FPGA Add-on for oneAPI Base Toolkit

API-Based Programming

- Intel® oneAPI Math Kernel Library - oneMKL
- Intel® oneAPI Threading Building Blocks - oneTBB
- Intel® oneAPI Data Analytics Library - oneDAL
- Intel® oneAPI Deep Neural Network Library - oneDNN
- Intel® oneAPI Collective Communications Library oneCCL
- Intel® oneAPI Video Processing Library - oneVPL
- Intel® oneAPI DPC++ Library oneDPL
- Intel® Integrated Performance Primitives - Intel® IPP

Analysis & debug Tools

- Intel® VTune™ Profiler
- Intel® Advisor
- Intel® Distribution for GDB

Learn More: intel.com/oneAPI-BaseKit

AI Development Cycle

Intel® oneAPI AI Analytics Toolkit

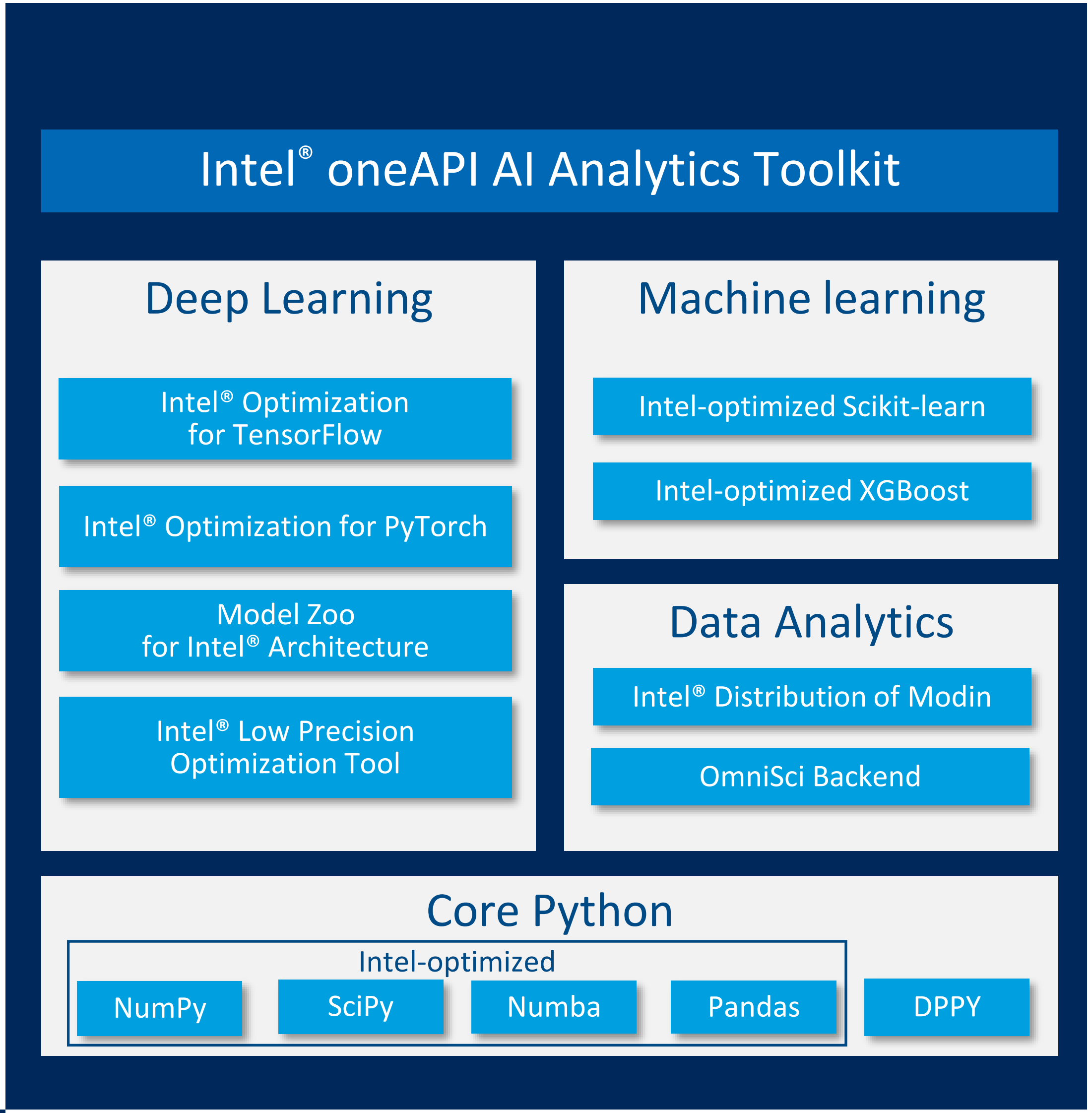
Accelerates end-to-end Machine Learning and Data Analytics pipelines with frameworks and libraries optimized for Intel® architectures

Target Model building, evaluating, training and datap preprocessing and data analytics in AI Development Cycle

Who Uses It?

Data scientists, AI Researchers, Machine and Deep Learning developers, AI application developers

Learn More: intel.com/oneAPI-AIKit


Intel® oneAPI AI Analytics Toolkit
Deep Learning
Intel® Optimization for TensorFlow
Intel® Optimization for PyTorch
Model Zoo for Intel® Architecture
Intel® Low Precision Optimization Tool
Machine learning
Intel-optimized Scikit-learn
Intel-optimized XGBoost
Data Analytics
Intel® Distribution of Modin
OmniSci Backend
Core Python
Intel-optimized
NumPy
SciPy
Numba
Pandas
DPPY

Performance Benefits

Maximize Hardware Value with Intel-optimized Software

Deep Learning Training & Inference Performance

Uses Intel® Optimization for PyTorch with 3rd Gen Intel® Xeon® Scalable Processors

Training	# Cores per instance	# Instances	BF16 (samples/s)	FP32 (samples/s)	Speedup Ratio
DLRM	28	1	99321	71061	**1.40**
ResNet-50	28	4	399	243	**1.64**
ResNeXt-101 32x4d	28	4	193	120	**1.60**

Table 1. BF16 training performance gains over baseline (FP32 with Intel oneDNN)

Inference	# Cores per instance	# Instances	INT8 (samples/s)	FP32 (samples/s)	Speedup Ratio
DLRM	1	28	611082	214559	**2.85**

Table 2. INT8 inference performance gains over baseline (FP32 with Intel oneDNN)

For more complete information about performance and benchmark results, visit www.intel.com/benchmarks.
See backup for configuration details.

ML Performance with Intel-optimized scikit-learn

```
from sklearn.svm import SVC
X, Y = get_dataset()

clf = SVC().fit(X, y)
res = clf.predict(X)
```

Common Scikit-learn (mainline)

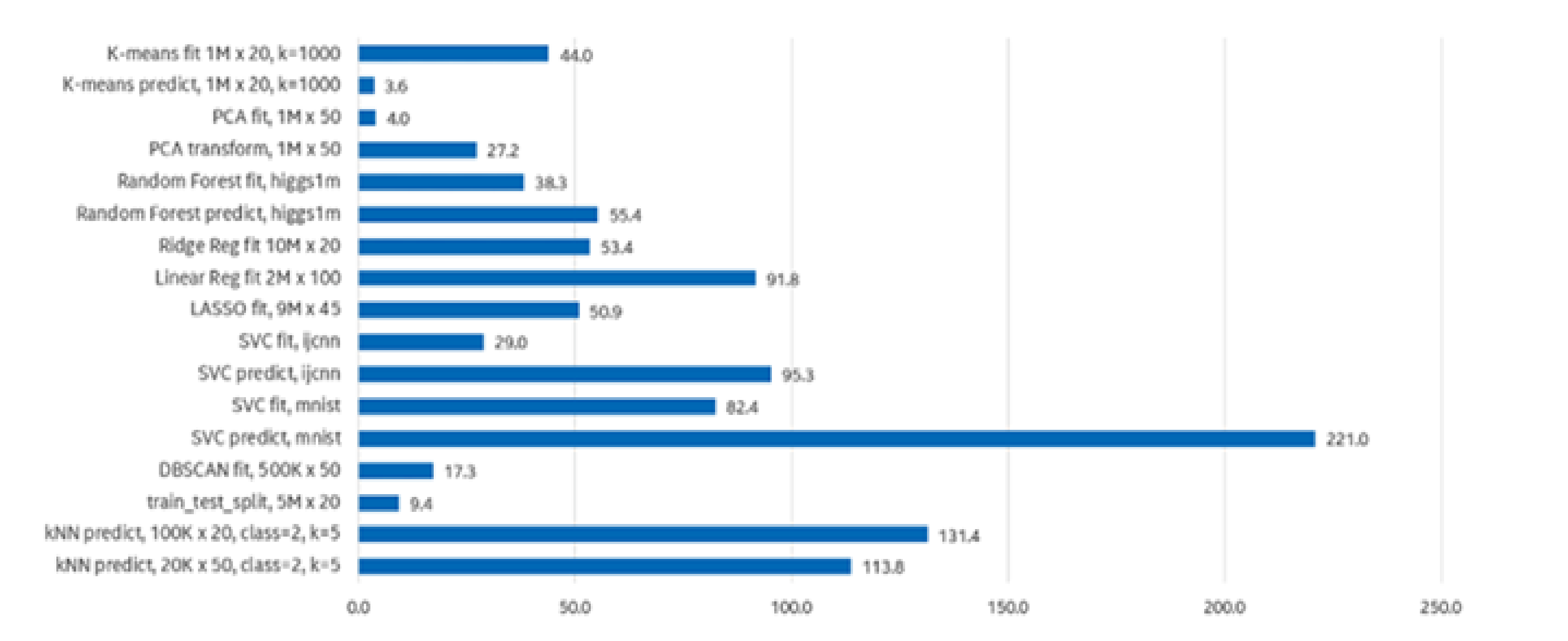
```
import daal4py as d4p
d4p.patch_sklearn()

from sklearn.svm import SVC
X, Y = get_dataset()

clf = SVC().fit(X, y)
res = clf.predict(X)
```

Scikit-learn on Intel CPU optimized by Intel® oneAPI AI Analytics Toolkit

Stock scikit-learn vs Intel-optimized scikit-learn



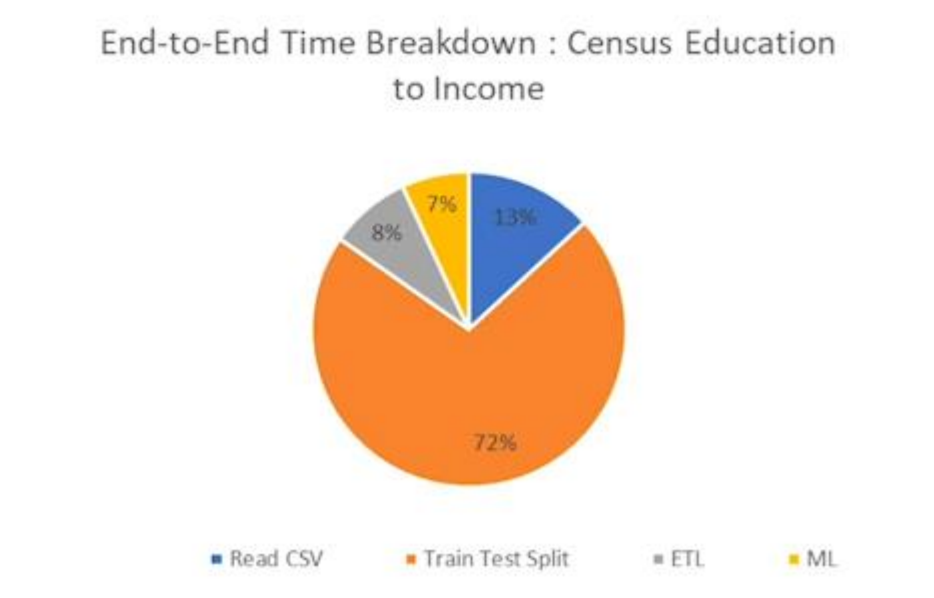
Same Code, Same Behavior

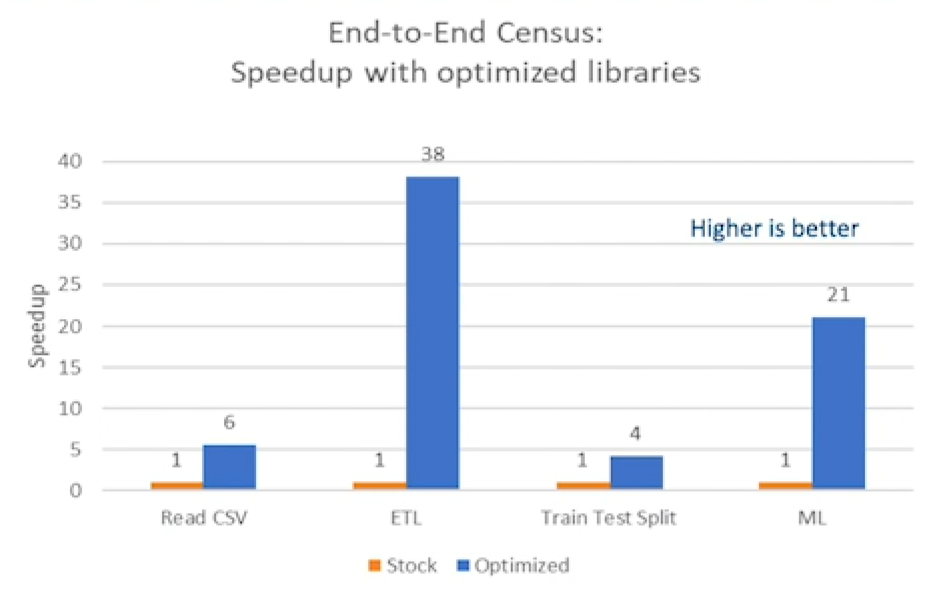
*Scikit-learn, **not** scikit-learn-like*

For more complete information about performance and benchmark results, visit www.intel.com/benchmarks.
See backup for configuration details.

End-to-End Data Pipeline Acceleration

- **Workload:** Train a model using 50 years of Census dataset from IPUMS.org to predict income based on education
- **Solution:** Intel Modin for data ingestion and ETL, Daal4Py and Intel scikit-learn for model training and prediction
- **Performance Gains**
  - Read_CSV (Read from disk and store as a dataframe): **6x**
  - ETL operations: **38x**
  - Train Test Split: **4x**
  - ML training (fit & predict) with Ridge Regression: **21x**





End-to-End Census Workload Performance
Tested by Intel as of 10/15/2020. 2x Intel® Xeon® Platinum 8280 @ 28cores, OS: Ubuntu 19.10.5.3.0-64-generic Mitigated, 384GB RAM. SW: Modin 0.8.1, scikit-learn 0.22.2, Pandas 1.0.1, Python 3.8.5, Daal4Py 2020.2 Census Data, (21721922, 45). Dataset is from IPUMS USA, University of Minnesota, www.ipums.org . Version 10.0.

AI Deployment Cycle

High-Performance Deep Learning Using Intel® Distribution of OpenVINO™ toolkit - Powered by oneAPI

A toolkit for fast, more accurate real-world results using high-performance AI and computer vision inference deployed into production on Intel XPU architectures (CPU, GPU, FPGA, VPU) from edge to cloud

Who needs this product?

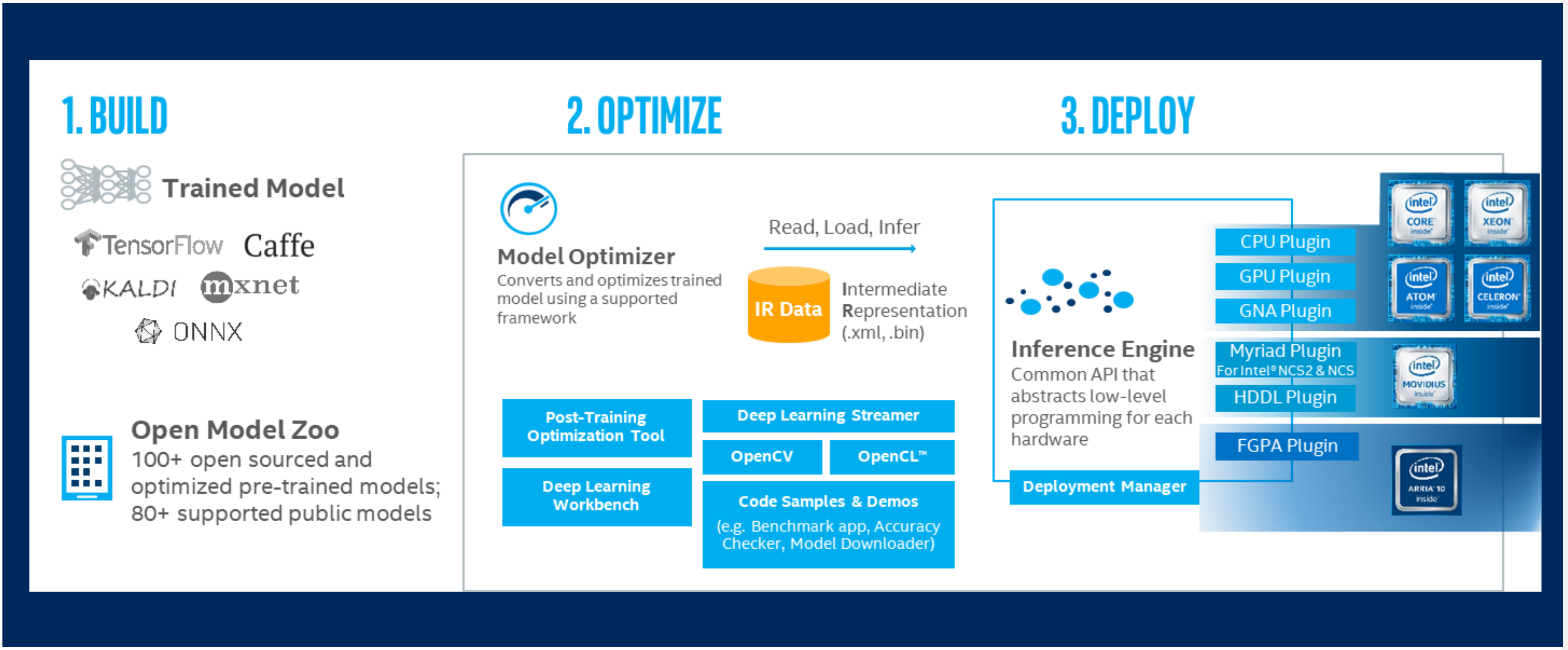
AI application developers, OEMs, ISVs, System Integrators, Vision and Media developers

Top Features/Benefits

High-performance, deep learning inference deployment

Streamlined development; ease of use

Write once, deploy anywhere



Proven, industry-leading accelerated technology

software.intel.com/openvino-toolkit

Which Toolkit Should I Use

Use Both!

Intel® oneAPI Analytics Toolkit & Intel® Distribution of OpenVINO™ toolkit

Toolkits are complementary to each other and recommendation is to use them both based on your current phase of AI Journey

- *I am **exploring and analyzing data;** I am **developing models***
- *I want **performance and compatibility** with frameworks and libraries I use*
- *I would like to have **drop-in acceleration** with little to no additional code changes*
- *I prefer **not to learn any new tools** or languages*

Data Scientist/ML Developer
Intel® oneAPI AI Analytics Toolkit

- *I am **deploying models***
- *I want **leading performance and efficiency** across multiple target HW*
- *I'm concerned about **having lower memory footprint**, which is critical for deployment*
- *I am **comfortable with learning and adopting a new tool or API** to do so*

App Developer
Intel® Distribution of OpenVINO™ toolkit

If you prefer working on primitives and to optimize kernels and algorithms directly using oneAPI libraries (oneDNN, oneCCL & oneDAL), then use Intel® oneAPI Base Toolkit

Customer Success Story

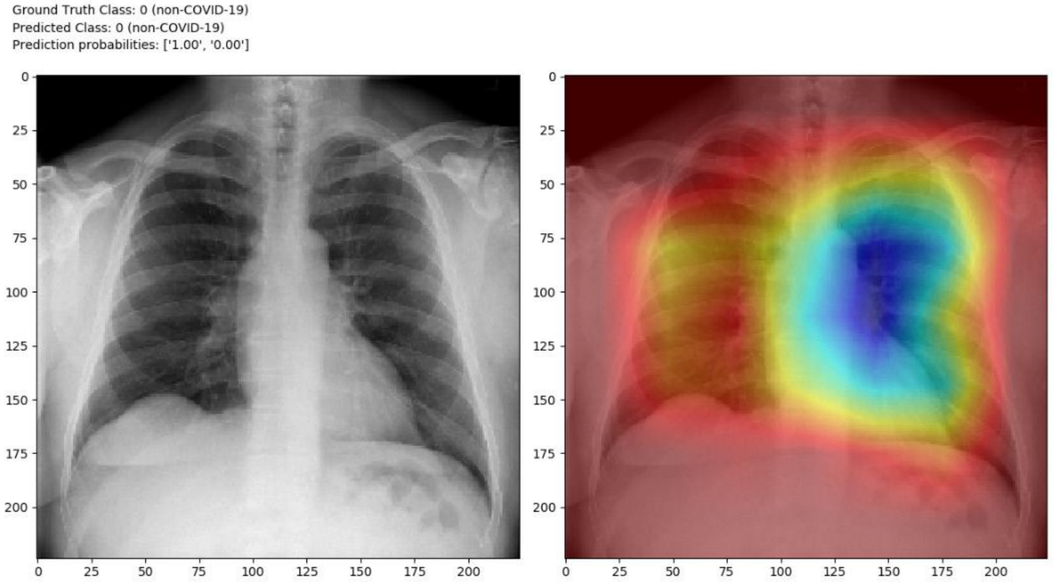
Accrad AI-based Solution Helps Accelerate Lung Disease Diagnosis

Optimized by Intel® oneAPI Analytics Toolkit & Intel® Distribution of OpenVINO™ toolkit

AI Machine Vision Disease Detection

CheXRad is a machine learning edge application that helps radiologists and physicians identify COVID-19, viral pneumonia and other diseases on chest X-ray images, and predict the need for ventilators.

- *CheXRad* comes pre-configured with a COVID-19 and viral pneumonia classification neural network.
- To architect, train and validate the neural network, Accrad used Intel Tensorflow from AI Analytics Toolkit and the infrastructure provided by Intel oneAPI DevCloud to develop the model.
- To optimize its model for deployment, Accrad used OpenVINO™ toolkit and Intel® DevCloud for Edge.
- *CheXRad* could label pathologies in 140 chest x-rays in just **90 seconds** —up to **160x faster** than radiologists, at comparable levels of accuracy, sensitivity and specificity.


Ground Truth Class: 0 (non-COVID-19)
Predicted Class: 0 (non-COVID-19)
Prediction probabilities: ['1.00', '0.00']
0
25
50
75
100
125
150
175
200
0
25
50
75
100
125
150
175
200

*"With the help of Intel, we were able to **train, optimize, and deploy** a machine learning model in **less time and at a lower operational cost** than available alternatives, enabling us to get to market fast with a powerful solution that's optimized for Intel® architecture." – Moloti Nakampe, R&D Director*

Learn more in this solution brief

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

AbbVie Machine Translation Solution

Optimized by Intel® oneAPI Analytics Toolkit & Intel® Distribution of OpenVINO™ toolkit

A research-based biopharmaceutical company powered by Intel® Xeon® processors.

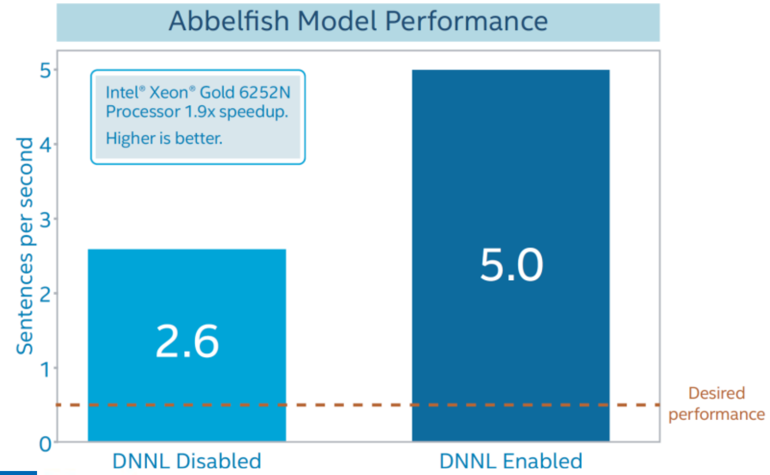
Abbelfish Machine Translation uses Intel® Optimization for TensorFlow of AI Analytics Toolkit

- A custom model that provides more accurate translations than commercially available ones. Model includes 24 layers and 500+ million parameters that took more than 4 months to train
- Intel TensorFlow provided a greater performance boost while AbbVie did not have to change its code or APIs from standard TensorFlow

AbbVie Search uses Intel® Distribution of OpenVINO™ toolkit

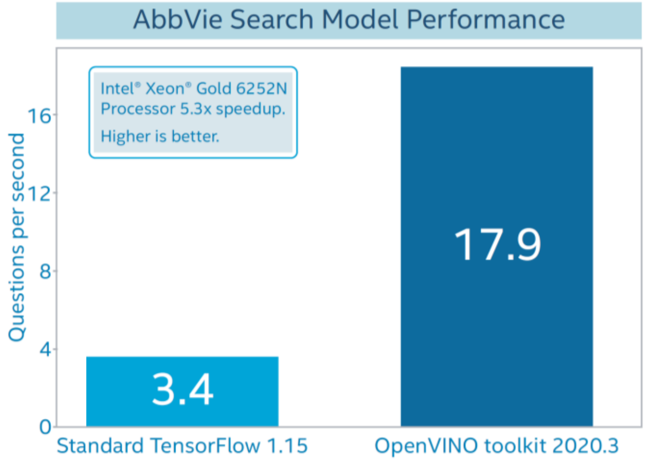
- OpenVINO toolkit provided great speed-up to answer questions from a scientific article or clinical report when compared to standard TensorFlow
- Requires scaling across the company, so uses OpenVINO™ Model Server to serve inferences

Learn more: Intel News Byte Dec. 15, 2020



Drop-in acceleration

Figure 3. AbbVie's Abbelfish translated over five sentences per second using Intel Optimization for TensorFlow with oneAPI Deep Neural Network Library (oneDNN).[1]



Deployment

Figure 5. Comparison of AbbVie Search inference between unoptimized TensorFlow 1.15 (oneDNN disabled) and OpenVINO toolkit 2020.3.[1]

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

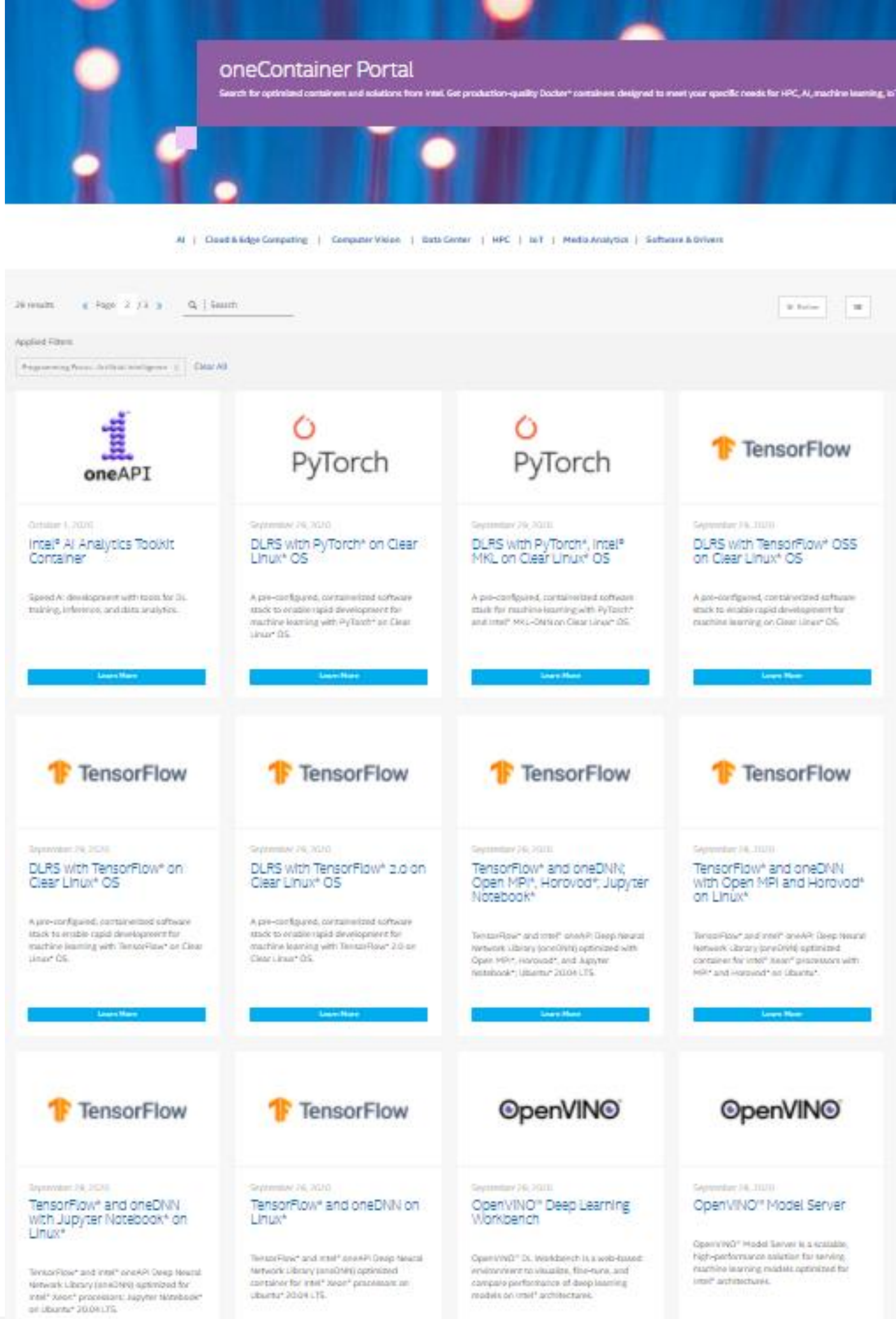
AI Containers for Flexibility

- Optimized, validated, deployable AI containers and artifacts for Intel® platforms
- Available via Docker containers and Intel software stacks. Will expand to include Kubernetes orchestrations, Helm charts, AI models, pipelines and more
- Access oneContainer Portal

Key Models (GPU-WIP, Check the portal for latest availability)

Topology	Frameworks
DLRM	PYT
ResNet50	PYT, TF, OV
BERT-large	PYT, TF, OV
Transformer-LT	PYT, TF
MobileNet-v1	PYT, TF, OV
SSD-Mobilenet-v1	PYT, TF, OV
SSD-Resnet34	PYT, TF, OV
WaveNet*	TF

Topology	Framework
Mask R-CNN	PYT, TF, OV
RNN-T	PYT, TF, OV
3D-UNet	TF, OV
DIEN	TF
Wide & Deep	PYT, TF
RNX101	
Yolo-V3	PYT, TF, OV
NCF*	TF



oneContainer Portal

Search for optimized containers and solutions from Intel. Get production-quality Docker* containers designed to meet your specific needs for HPC, AI, machine learning, IoT

October 1, 2020
Intel® AI Analytics Toolkit Container
Speed AI development with tools for DL training, inference, and data analytics.

September 29, 2020
DLRS with PyTorch* on Clear Linux* OS
A pre-configured, containerized software stack to enable rapid development for machine learning with PyTorch* on Clear Linux* OS.

September 29, 2020
DLRS with PyTorch*, Intel® MKL on Clear Linux* OS
A pre-configured, containerized software stack for machine learning with PyTorch* and Intel® MKL-DNN on Clear Linux* OS.

September 28, 2020
DLRS with TensorFlow* OSS on Clear Linux* OS
A pre-configured, containerized software stack to enable rapid development for machine learning on Clear Linux* OS.

September 29, 2020
DLRS with TensorFlow* on Clear Linux* OS
A pre-configured, containerized software stack to enable rapid development for machine learning with TensorFlow* on Clear Linux* OS.

September 28, 2020
DLRS with TensorFlow* 2.0 on Clear Linux* OS
A pre-configured, containerized software stack to enable rapid development for machine learning with TensorFlow* 2.0 on Clear Linux* OS.

September 26, 2020
TensorFlow* and oneDNN; Open MPI*, Horovod*, Jupyter Notebook*
TensorFlow* and Intel® oneAPI Deep Neural Network Library (oneDNN) optimized with Open MPI*, Horovod*, and Jupyter Notebook*; Ubuntu* 20.04 LTS.

September 18, 2020
TensorFlow* and oneDNN with Open MPI and Horovod* on Linux*
TensorFlow* and Intel® oneAPI Deep Neural Network Library (oneDNN) optimized container for Intel® Xeon® processors with MPI* and Horovod* on Ubuntu*.

September 28, 2020
TensorFlow* and oneDNN with Jupyter Notebook* on Linux*
TensorFlow* and Intel® oneAPI Deep Neural Network Library (oneDNN) optimized for Intel® Xeon® processors; Jupyter Notebook* on Ubuntu* 20.04 LTS.

September 26, 2020
TensorFlow* and oneDNN on Linux*
TensorFlow* and Intel® oneAPI Deep Neural Network Library (oneDNN) optimized container for Intel® Xeon® processors on Ubuntu* 20.04 LTS.

September 26, 2020
OpenVINO™ Deep Learning Workbench
OpenVINO™ DL Workbench is a web-based environment to visualize, fine-tune, and compare performance of deep learning models on Intel® architectures.

September 18, 2020
OpenVINO™ Model Server
OpenVINO™ Model Server is a scalable, high-performance solution for serving machine learning models optimized for Intel® architectures.

Key Takeaways & Call to Action

- Intel toolkits are FREE, complementary & work seamlessly together
- They help achieve performance & efficiency across different stages of AI Journey
- Recommend the toolkits based on current phase of customer pipeline

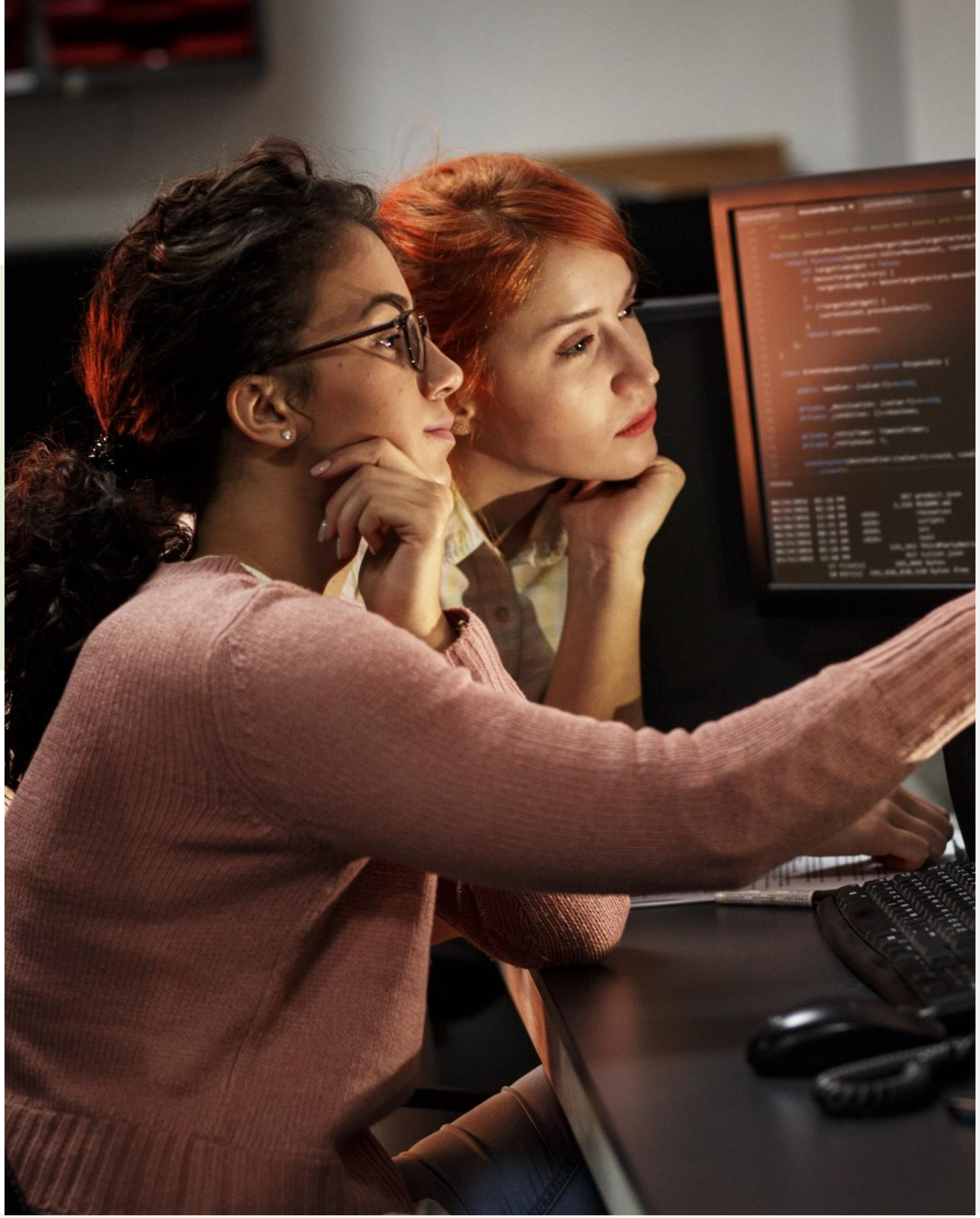
Download the toolkits

Intel® oneAPI AI Analytics Toolkit

Intel® Distribution of OpenVINO ™ toolkit

Intel® oneAPI Base Toolkit

Learn more about Intel® oneAPI Toolkits
intel.com/oneAPI-AllToolkits



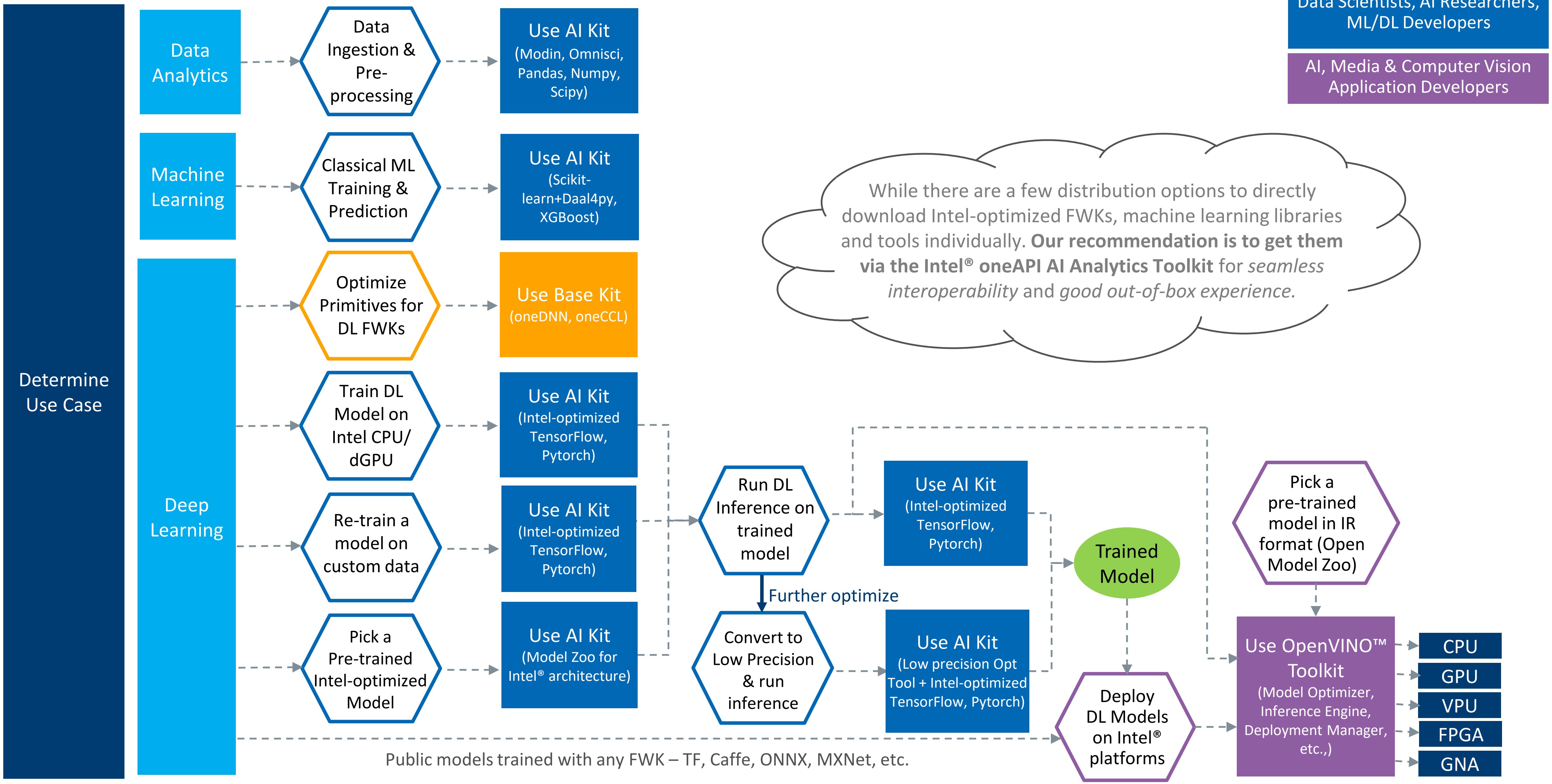
BackUp

AI Development Workflow

Native Code Developers, Framework Developers

Data Scientists, AI Researchers, ML/DL Developers

AI, Media & Computer Vision Application Developers



Determine Use Case

Data Analytics

Data Ingestion & Pre-processing

Use AI Kit (Modin, Omnisci, Pandas, Numpy, Scipy)

Machine Learning

Classical ML Training & Prediction

Use AI Kit (Scikit-learn+Daal4py, XGBoost)

Deep Learning

Optimize Primitives for DL FWKs

Use Base Kit (oneDNN, oneCCL)

Train DL Model on Intel CPU/ dGPU

Use AI Kit (Intel-optimized TensorFlow, Pytorch)

Re-train a model on custom data

Use AI Kit (Intel-optimized TensorFlow, Pytorch)

Pick a Pre-trained Intel-optimized Model

Use AI Kit (Model Zoo for Intel® architecture)

Run DL Inference on trained model

Use AI Kit (Intel-optimized TensorFlow, Pytorch)

Further optimize

Convert to Low Precision & run inference

Use AI Kit (Low precision Opt Tool + Intel-optimized TensorFlow, Pytorch)

Trained Model

Deploy DL Models on Intel® platforms

Pick a pre-trained model in IR format (Open Model Zoo)

Use OpenVINO™ Toolkit (Model Optimizer, Inference Engine, Deployment Manager, etc.,)

CPU

GPU

VPU

FPGA

GNA

Public models trained with any FWK – TF, Caffe, ONNX, MXNet, etc.

While there are a few distribution options to directly download Intel-optimized FWKs, machine learning libraries and tools individually. **Our recommendation is to get them via the Intel® oneAPI AI Analytics Toolkit** for *seamless interoperability* and *good out-of-box experience.*

AI Kit = Intel® oneAPI AI Analytics Toolkit
Base Kit = Intel® oneAPI Base Toolkit

Getting Started with Intel® oneAPI AI Analytics Toolkit

Overview

- Visit Intel® oneAPI AI Analytics Toolkit (AI Kit) for more details and up-to-date product information
- Release Notes

Installation

- Download the AI Kit from Intel, Anaconda or any of your favorite package managers
- Get started quickly with the AI Kit Docker Container
- Installation Guide
- Utilize the Getting Started Guide

Hands on

- Code Samples
- Build, test and remotely run workloads on the Intel® DevCloud for free. No software downloads. No configuration steps. No installations.

Learning

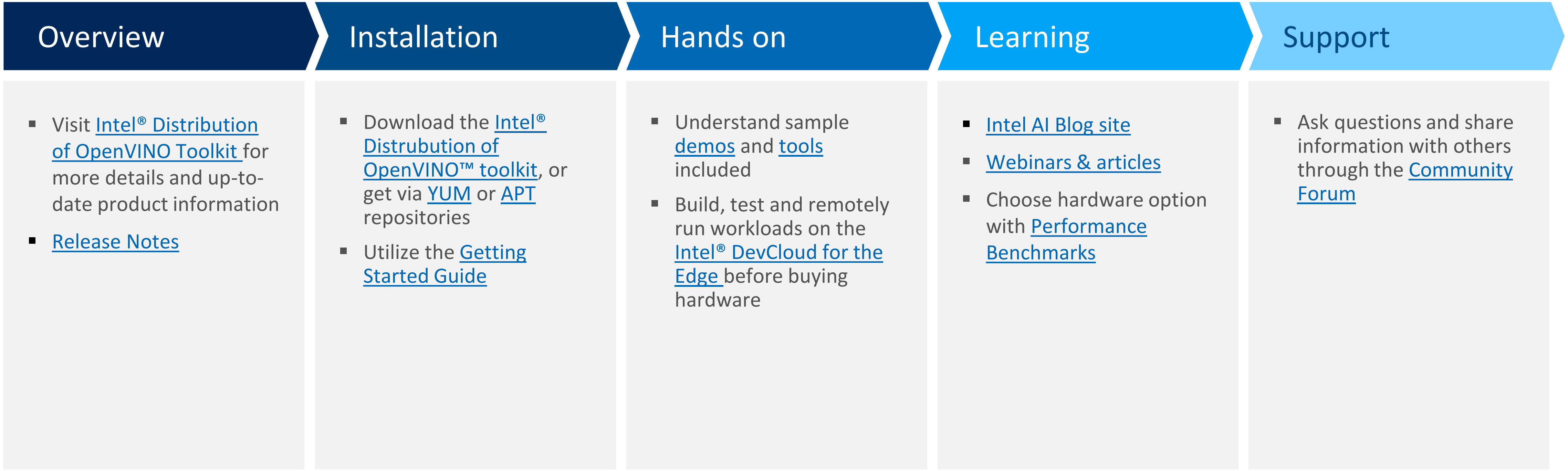
- Machine Learning & Analytics Blogs
- Intel AI Blog site
- Webinars & articles

Support

- Ask questions and share information with others through the Community Forum
- Discuss with experts at AI Frameworks Forum

Download Now

Getting Started with Intel® Distribution of OpenVINO™ Toolkit



Overview

- Visit Intel® Distribution of OpenVINO Toolkit for more details and up-to-date product information
- Release Notes

Installation

- Download the Intel® Distrubution of OpenVINO™ toolkit, or get via YUM or APT repositories
- Utilize the Getting Started Guide

Hands on

- Understand sample demos and tools included
- Build, test and remotely run workloads on the Intel® DevCloud for the Edge before buying hardware

Learning

- Intel AI Blog site
- Webinars & articles
- Choose hardware option with Performance Benchmarks

Support

- Ask questions and share information with others through the Community Forum

Download Now

Notices & Disclaimers

Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

Your costs and results may vary.

Intel technologies may require enabled hardware, software or service activation.

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

Configurations

Deep Learning Training and Inference Performance using Intel® Optimization for PyTorch with 3rd Gen Intel® Xeon® Scalable Processors
ResNet50/ResNext101 (FP32/BF16): batch size 128/instance, 4 instances.
ResNet50/ResNext101 dataset (FP32/BF16): ImageNet Dataset
DLRM batch size (FP32/BF16): 2K/instance, 1 instance
DLRM dataset (FP32/BF16): Criteo Terabyte Dataset
DLRM batch size (INT8): 16/instance, 28 instances, dummy data.
Tested by Intel as of 6/2/2020.
Intel® Xeon® Platinum 8380H Processor, 4 socket, 28 cores HT On Turbo ON Total Memory 768 GB (24 slots/ 32GB/ 3200 MHz), BIOS: WLYDCRB1.SYS.0015.P96.2005070242 (ucode: 0x700001b), Ubuntu 20.04 LTS, kernel 5.4.0-29-generic
PyTorch: https://github.com/pytorch/pytorch.git
Intel Extension for PyTorch: https://github.com/intel/intel-extension-for-pytorch.git
gcc: 8.4.0,
Intel® oneAPI Deep Neural Network Library (oneDNN) version: v1.4
ResNet50: https://github.com/intel/optimized-models/tree/master/pytorch/ResNet50
ResNext101 32x4d: https://github.com/intel/optimized-models/tree/master/pytorch/ResNext101_32x4d
DLRM: https://github.com/intel/optimized-models/tree/master/pytorch/dlrm

Inference Throughput FP32 vs Int8 optimized by Intel® Optimization for Tensorflow and Intel® Low Precision Optimization Tool (part of the Intel® oneAPI AI Analytics Toolkit)
Tested by Intel as of : 10/26/2020: TensorFlow v2.2 (https://github.com/Intel-tensorflow/tensorflow/tree/v2.2.0); Compiler: GCC 7.2.1; DNNL(https://github.com/oneapi-src/oneDNN) v1.2.0 75d0b1a7f3586c212e37acebbb8acd221cee7216; Dataset: ImageNet/Coco/Dummy, refer to each model README; Precision: FP32 and Int8
Platform: Intel® Xeon® Platinum 8280 CPU; #Nodes: 1; #Sockets: 2; Cores/socket: 28; Threads/socket: 56; HT: On; Turbo: On; BIOS version: SE5C620.86B.02.01.0010.010620200716; System DDR Mem Config: 12 slots / 16GB / 2933; OS: CentOS Linux 7.8; Kernel: 4.4.240-1.el7.elrepo.x86_64

Stock scikit-learn vs Intel-optimized scikit-learn
Testing by Intel as of 10/23/2020. Intel® oneAPI Data Analytics Library 2021.1 (oneDAL), scikit-learn 0.23.1, Intel® Distribution for Python 3.8; Intel® Xeon® Platinum 8280LCPU @ 2.70GHz, 2Sockets, 28 cores per socket, 10M samples, 10 features, 100 clusters, 100 iterations, float32

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

XGBoost CPU vs GPU

Test configs: Tested by Intel as of 10/13/2020;
CPU: c5.18xlarge AWS Instance (2 x Intel® Xeon Platinum 8124M @ 18 cores, OS: Ubuntu 20.04.2 LTS, 193 GB RAM. GPU: p3.2xlarge AWS Instance (GPU: NVIDIA Tesla V100 16GB, 8 vCPUs), OS: Ubuntu 18.04.2 LTS, 61 GB RAM. SW: XGBoost 1.1:build from sources. compiler – G++ 7.4, nvcc 9.1. Intel® Data Analytics Acceleration Library (Intel® DAAL): 2019.4 version; Python env: Python 3.6, Numpy 1.16.4, Pandas 0.25, Scikit-lean 0.21.2.

XGBoost fit CPU acceleration

Test configs: Tested by Intel as of 10/13/2020; c5.24xlarge AWS Instance, CLX 8275 @ 3.0GHz, 2 sockets, 24 cores per socket, HT:on, DRAM (12 slots / 32GB / 2933 MHz); SW: XGBoost 0.81, 0.9, 1.0 and 1.1:build from sources. compiler – G++ 7.4, nvcc 9.1. Intel® DAAL: 2019.4 version; Python env: Python 3.6, Numpy 1.16.4, Pandas 0.25, Scikit-lean 0.21.2.

End-to-End Census Workload Performance

Tested by Intel as of 10/15/2020. 2x Intel® Xeon® Platinum 8280 @ 28cores, OS: Ubuntu 19.10.5.3.0-64-generic Mitigated, 384GB RAM. SW: Modin 0.8.1, scikit-learn 0.22.2, Pandas 1.0.1, Python 3.8.5, Daal4Py 2020.2 Census Data, (21721922, 45). Dataset is from IPUMS USA, University of Minnesota, www.ipums.org . Version 10.0.

Tiger Lake + Intel® Distribution of OpenVINO™ toolkit vs Coffee Lake CPU

System Board	Intel prototype, TGL U DDR4 SODIMM RVP	ASUSTeK COMPUTER INC. / PRIME Z370-A
CPU	11th Gen Intel® Core™ -5-1145G7E @ 2.6 GHz.	8th Gen Intel® Core™ i5-8500T @ 3.0 GHz.
Sockets / Physical cores	1 / 4	1 / 6
HyperThreading / Turbo Setting	Enabled / On	Na / On
Memory	2 x 8198 MB 3200 MT/s DDR4	2 x 16384 MB 2667 MT/s DDR4
OS	Ubuntu* 18.04 LTS	Ubuntu* 18.04 LTS
Kernel	5.8.0-050800-generic	5.3.0-24-generic
Software	Intel® Distribution of OpenVINO™ toolkit 2021.1.075	Intel® Distribution of OpenVINO™ toolkit 2021.1.075
BIOS	Intel TGLIFUI1.R00.3243.A04.2006302148	AMI, version 2401
BIOS release date	Release Date: 06/30/2020	7/12/2019
BIOS Setting	Load default settings	Load default settings, set XMP to 2667
Test Date	9/9/2020	9/9/2020
Precision and Batch Size	CPU: INT8, GPU: FP16-INT8, batch size: 1	CPU: INT8, GPU: FP16-INT8, batch size: 1
Number of Inference Requests	4	6
Number of Execution Streams	4	6
Power (TDP Link)	28 W	35W

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Thank You.